

What is claimed is:

1. A process for making a hard pellicle for a photomask, comprising the following steps:
 - 5 (i) providing a substrate having a substantially flat surface;
 - (ii) depositing an intermediate layer comprising an amorphous silicon layer on top of the substantially flat surface of the substrate;
 - (iii) depositing a pellicle layer having a first surface and a second surface on the surface of the intermediate layer, with the first surface bonding to the surface of the
10 intermediate layer, and the second surface opposite to the first surface;
 - (iv) bonding a pellicle mount frame to the second surface of the pellicle layer; and
 - (v) separating the pellicle layer and a portion of the intermediate layer from the substrate at a location within the intermediate layer by heat treatment.
2. A process in accordance with claim 1, wherein the intermediate layer is a single
15 layer consisting essentially of hydrogenated amorphous silicon.
3. A process in accordance with claim 1, wherein the intermediate layer is a multiple-layer system comprising a first layer of hydrogenated amorphous silicon and a second layer which is fluorinated, wherein the first layer and the second layer have direct contact with each other.
- 20 4. A process in accordance with claim 3, wherein the second layer is fluorine doped silica or fluorine doped SiN layer.
5. A process in accordance with claim 3, wherein the first layer is deposited first, and the second layer is deposited on top of the first layer thereafter.
6. A process in accordance with claim 3, wherein the second layer is deposited first,
25 and the first layer is deposited on top of the second layer thereafter.
7. A process in accordance with claim 1, wherein the substrate in step (i) is flat sheet glass, a fused silica wafer, a silicon wafer, or a silicon wafer having a thermal oxidization layer.
8. A process in accordance with claim 1, wherein in step (iii), the pellicle layer
30 consists essentially of a material selected from silica, fluorine doped silica, aluminum

doped silica, methylated silica, fluorinated and methylated silica, fluorinated aluminum doped silica, CaF_2 , MgF_2 , BaF_2 and SiC .

9. A process in accordance with claim 1, wherein in steps (ii) and (iii), the intermediate layer and the pellicle layer are independently deposited via chemical vapor deposition and/or plasma vapor deposition, or sol-gel process.

10. A process in accordance with claim 9, wherein in steps (ii) (iii), the intermediate layer and the pellicle layer are independently deposited via a process selected from plasmas enhanced chemical vapor deposition (PECVD), low pressure chemical vapor deposition (LPCVD), sub-atmospheric chemical vapor deposition (SACVD), ion-assisted e-beam evaporation, non ion-assisted e-beam evaporation and sputtering.

11. A process in accordance with claim 9, wherein in steps (ii) and (iii), the intermediate layer and pellicle layer are deposited via plasma enhanced chemical vapor deposition (PECVD).

12. A process in accordance with claim 1, wherein in step (iv), the bonding between the pellicle layer and the pellicle mount frame is effected by wafer bonding.

13. A process in accordance with claim 12, wherein the bonding is effected by anodic bonding, low-temperature bonding or fusion bonding.

14. A process in accordance with claim 1, wherein in step (iv), the bonding between the pellicle layer and the pellicle mount frame is effected by using frit.

15. A process in accordance with claim 1, wherein in step (iv), the pellicle mount frame consists essentially of a material having substantially the same coefficient of thermal expansion as that of the pellicle layer.

16. A process in accordance with claim 1, wherein in step (iv), the pellicle mount frame consists essentially of silica.

17. A process in accordance with claim 15, wherein the pellicle mount frame is porous and allows for the passage of purging gas used during the lithographic process.

18. A process in accordance with claim 1, wherein the heat treatment used in step (v) for separating the pellicle layer and a portion of the intermediate layer is effected by laser heating.

19. A process in accordance with claim 1, further comprising either a further step (vi) as follows:

(vi) removing the residual material from the intermediate layer on top of the first surface of the pellicle layer;

5 or a step (vii) as follows:

(vii) converting the residual material from the intermediate layer on top of the first surface of the pellicle layer to a material compatible with the pellicle layer.

20. A process in accordance with claim 19, wherein step (vi) is carried out, in which plasma etching is used to remove the residual material from the intermediate layer.

10 21. A process in accordance with claim 19, wherein step (vii) is carried out, in which thermal oxidation is used to convert the residual material from the intermediate layer to a material compatible with the pellicle layer.

22. A process in accordance with claim 1, further comprising the following step (viii) after step (v):

15 (viii) forming an antireflective coating on at least the pellicle surface opposite to the pellicle mount frame.

23. A process in accordance with claim 19, further comprising the following step (viii) after step (vi) or (vii):

20 (viii) forming an antireflective coating on at least the pellicle surface opposite to the pellicle mount frame.